

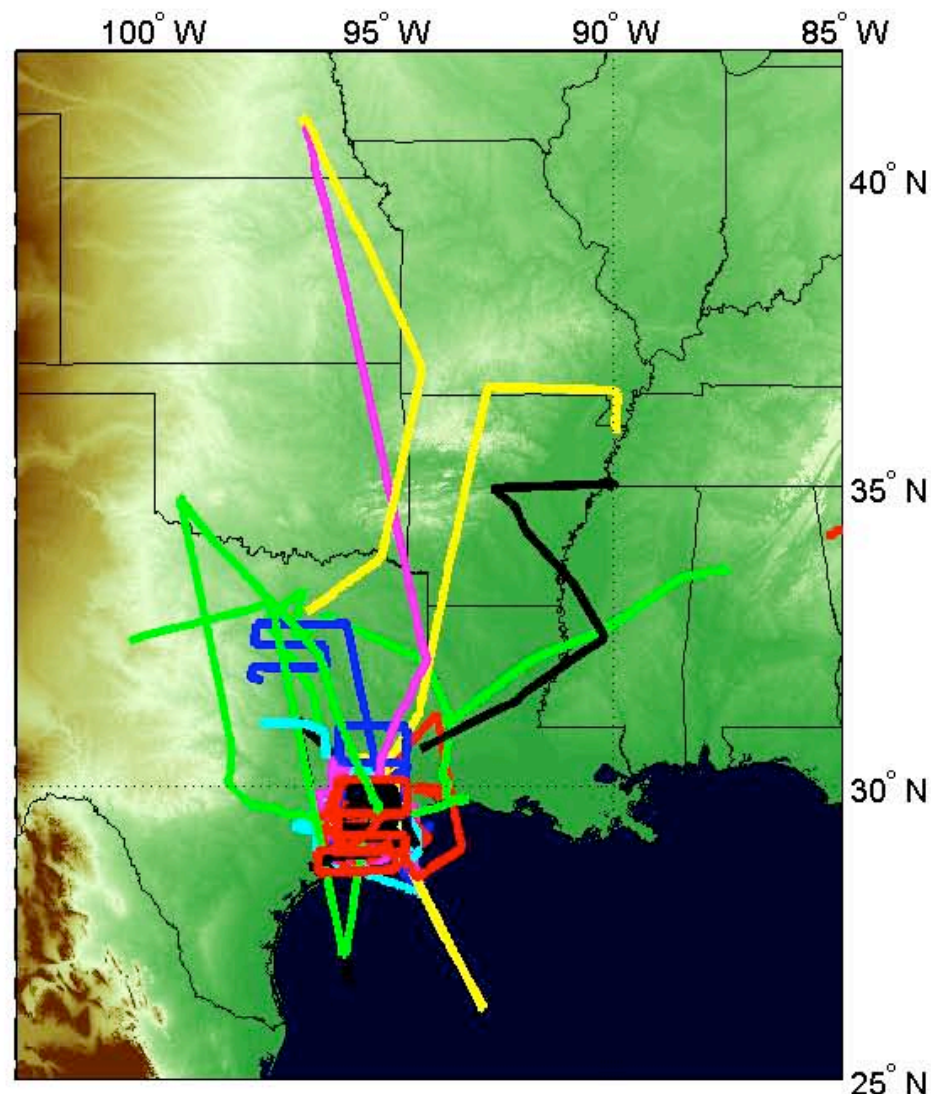
First Look at Airborne High Spectral Resolution Lidar Observations from MAX-TEX/GoMACCS



Chris Hostetler, Rich Ferrare, John Hair, David Harper, Anthony Cook,
Chieko Kittaka, Brad Pierce
NASA Langley Research Center, Hampton, VA

Funded by
NASA HQ Science Mission Directorate Radiation Sciences Program & CALIPSO validation
Department of Energy Atmospheric Science Program

HSRL Deployment on 2006 MAX-TEX/GoMACCS



King Air flight tracks
Aug 28 – Sept 28, 2006

- Texas Region/Gulf of Mexico Aerosol Composition and Climate Study
- Instruments on King Air
 - **HSRL** (primary)
 - LAABS
 - HySPAR
 - Digital camera (nadir)
- Project Objectives
 - Augment MAX-TEX/GoMACCS radiation and air quality objectives. Aerosol Vertical and Horizontal Distributions.
 - Satellite Validation – CALIPSO, MODIS, MISR, POLDER
 - Investigate new remote sensing strategies and retrieval techniques
 - Aerosol Transport Model Evaluation
- 22 science flights, >90 flight hours
 - 7 flights with NOAA WP-3
 - 6 flights with NOAA Twin Otter
 - 7 flights with CIRPAS Twin Otter
 - 2 flights over the RHB
 - Numerous Overflights of Moody Tower
 - 10 CALIPSO validation flights
 - 4 MISR LM coincidences
 - 14 MODIS coincidences

Airborne High Spectral Resolution Lidar

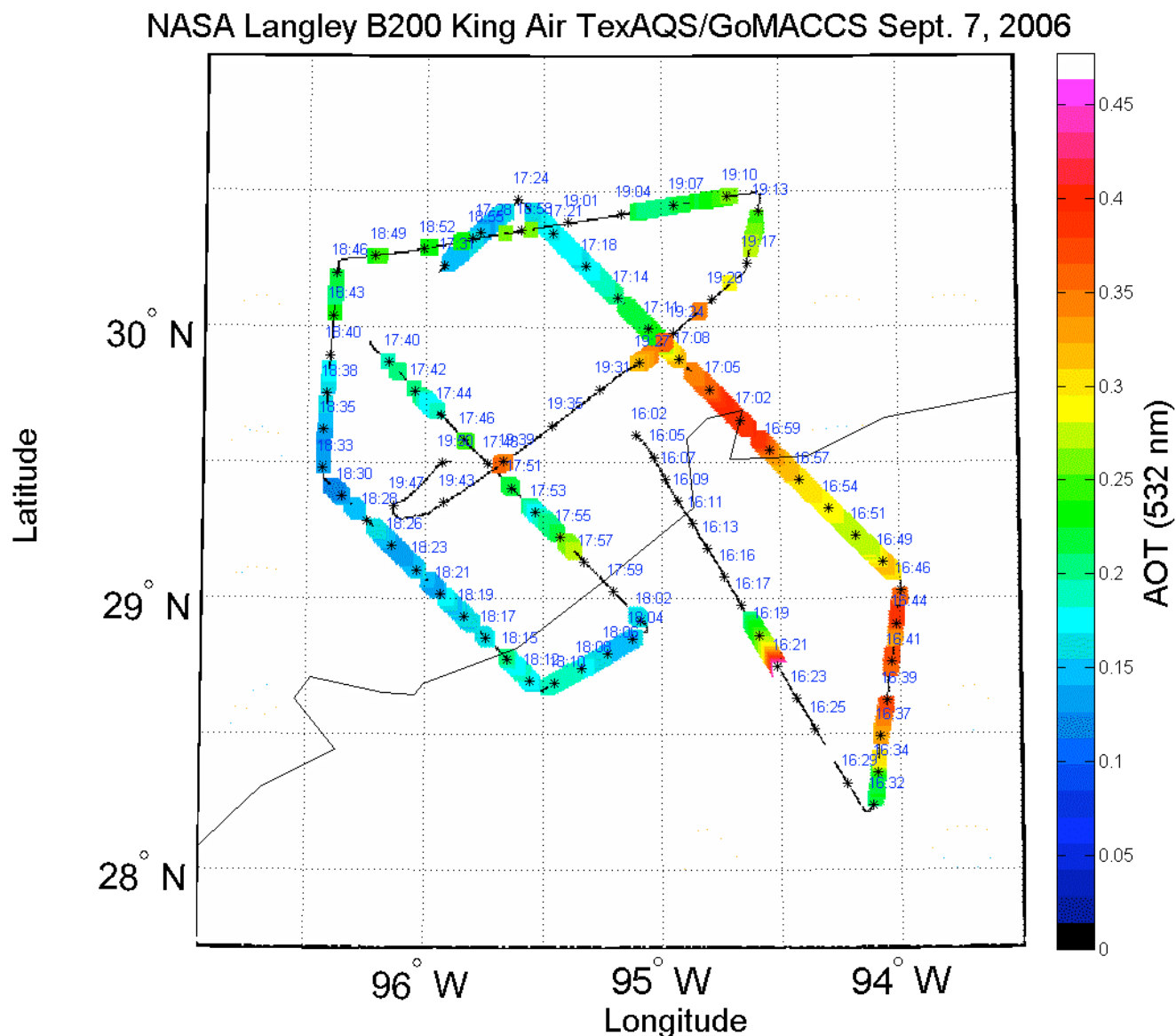


- Measurements
 - Extinction at 532 nm
 - Backscatter at 532 nm
 - Backscatter at 1064 nm
 - Depolarization at 532 nm
 - Depolarization at 1064 nm
- History
 - 2000-2004
 - instrument development and integration
 - Dec 2004:
 - first test flight on Lear 25-C
 - Dec 2005:
 - first test flight NASA Langley King Air
 - >200 flight hours on instrument since completion, including
 - 60 hours on MILAGRO/MAXMEX
 - 60 hours CALIPSO Validation
 - 90 hours on 2006 MAXTEX/TexAQS/GoMACCS

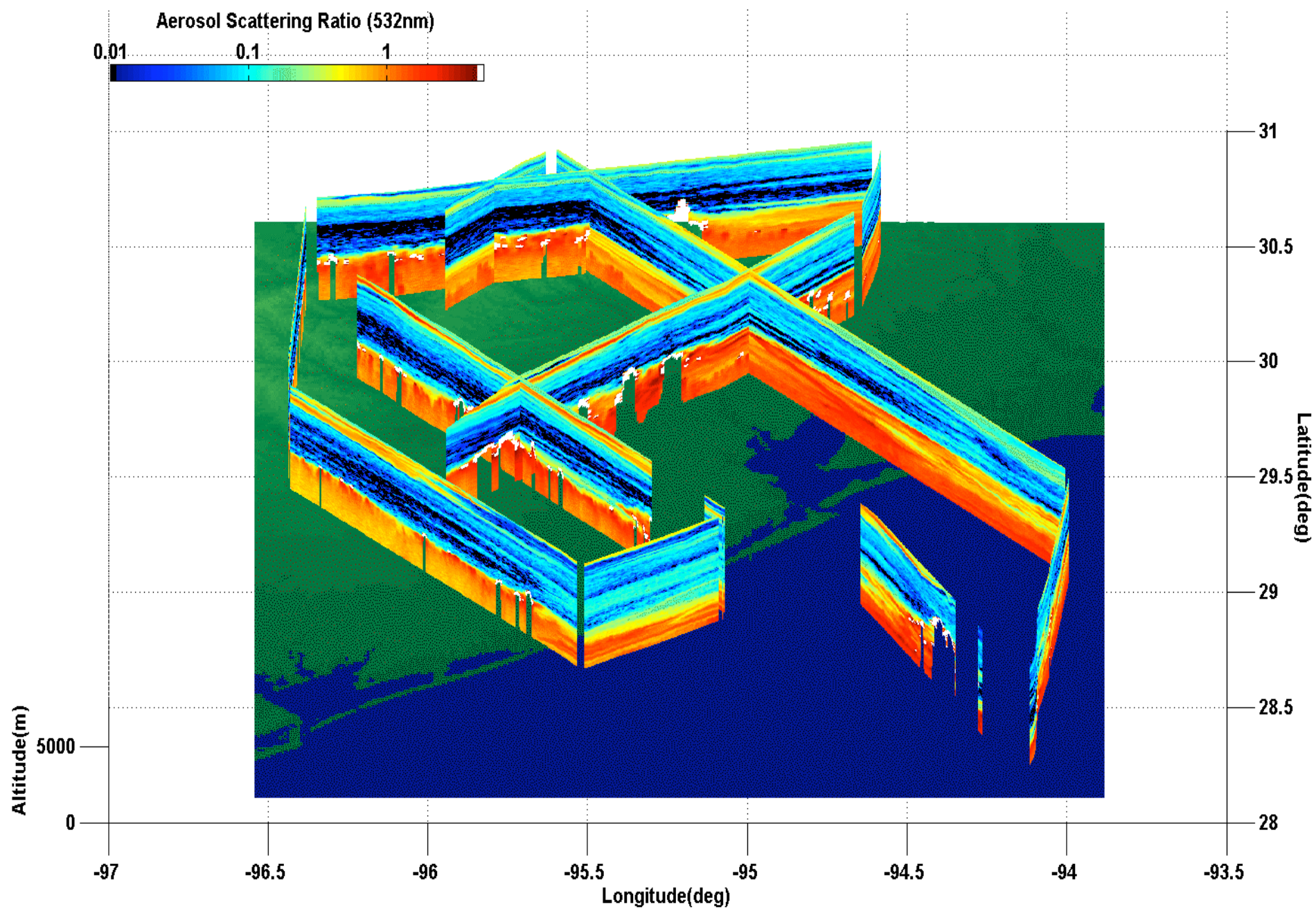
Observations of Urban Aerosol and Smoke from Pacific NW

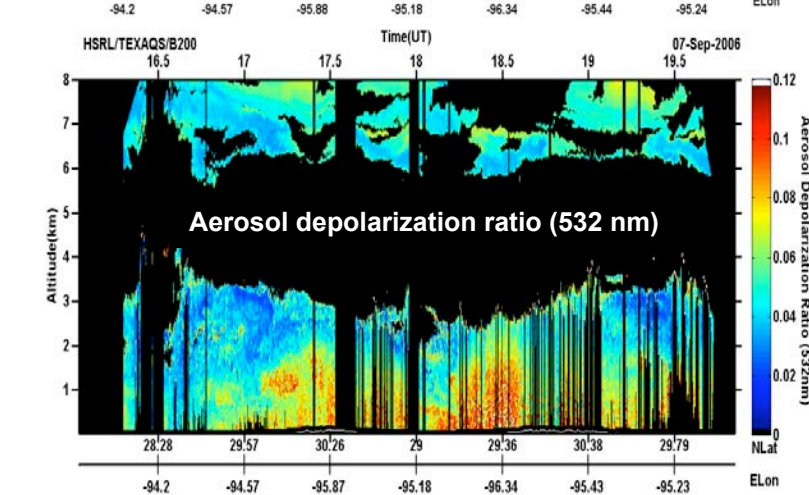
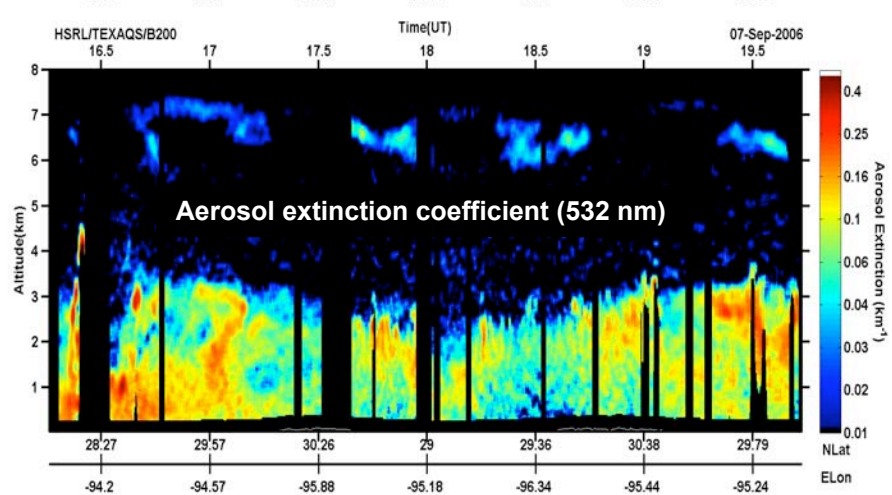
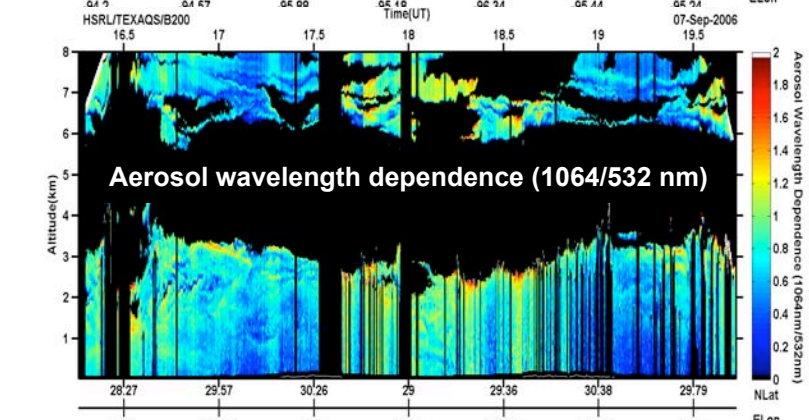
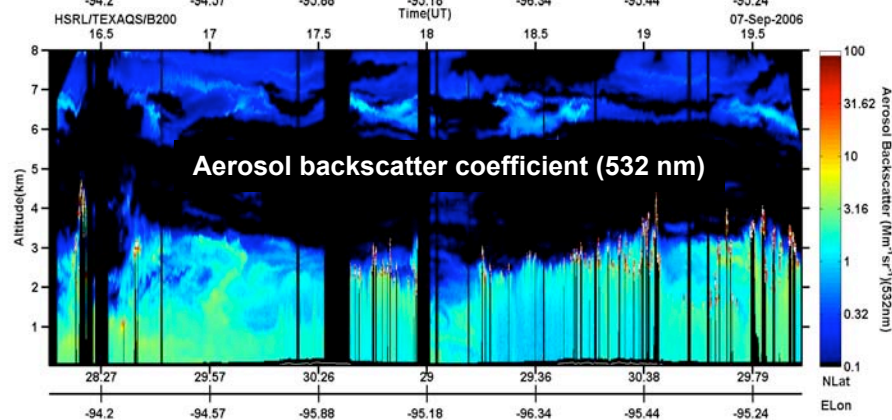
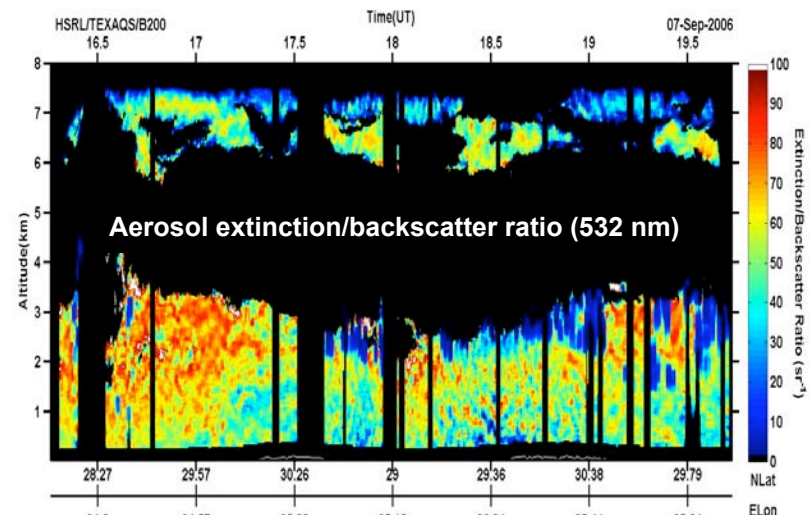
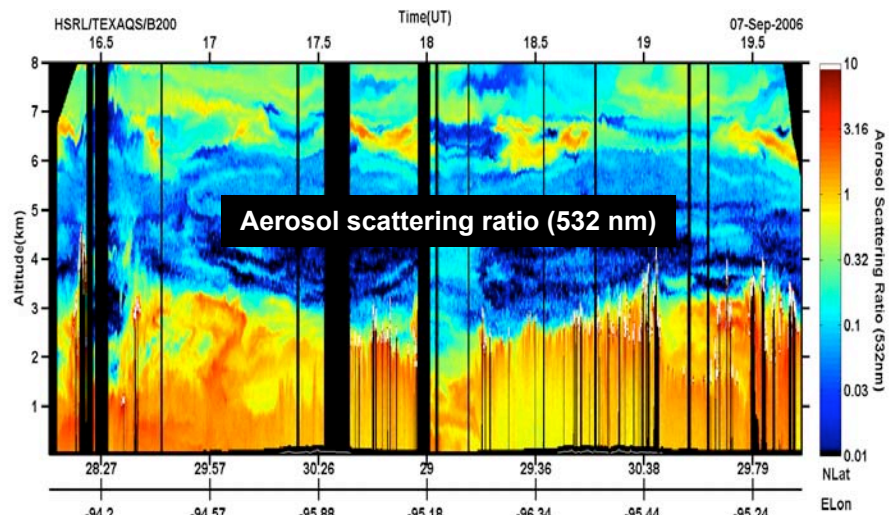


- Relatively high aerosol loading
- Biomass aerosol observed at higher altitudes
- Coordination
 - NOAA P3
 - NOAA Twin Otter
 - Ozone Lidar
 - Moody Tower

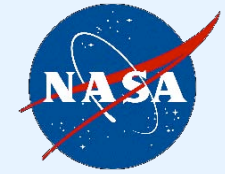


September 7, 2006

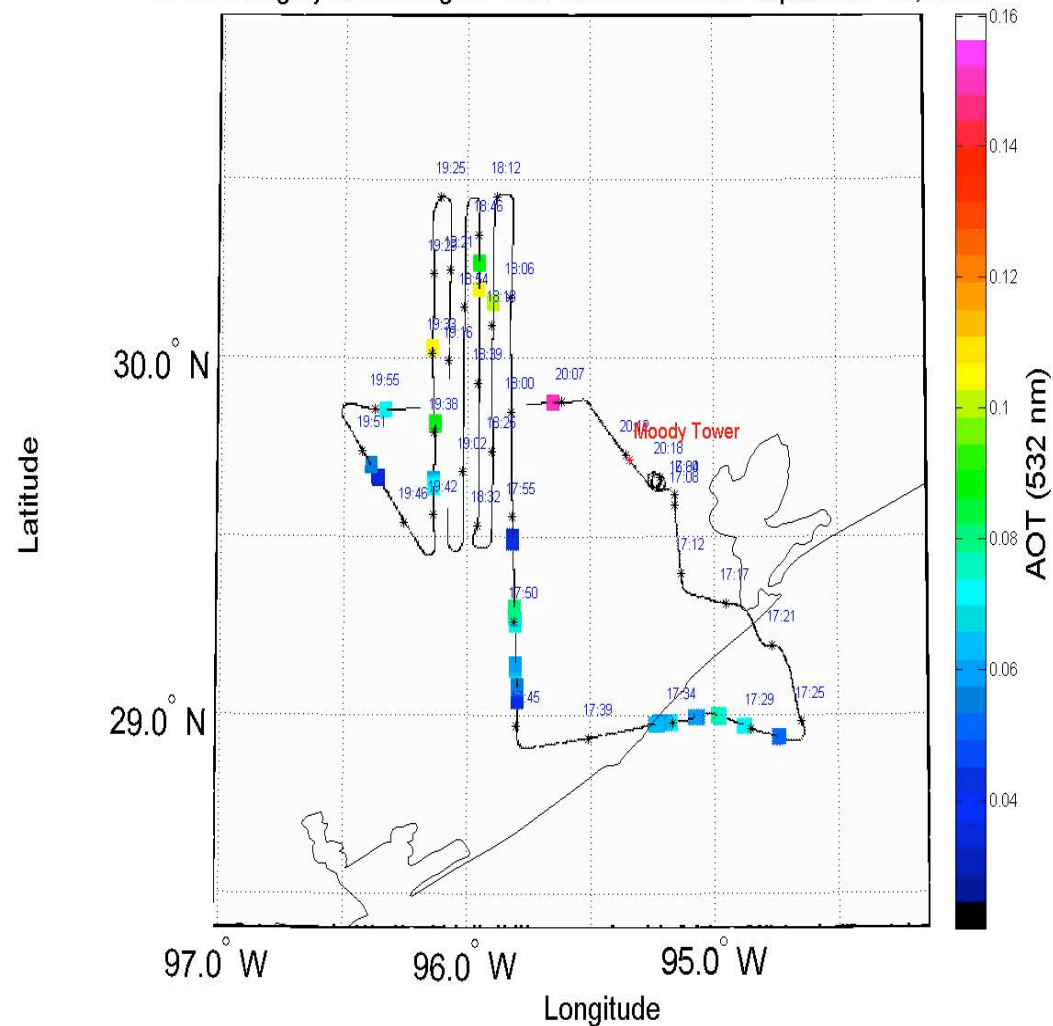




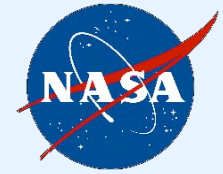
Aerosol between/above broken Cu: Precursor to CHAPS campaign



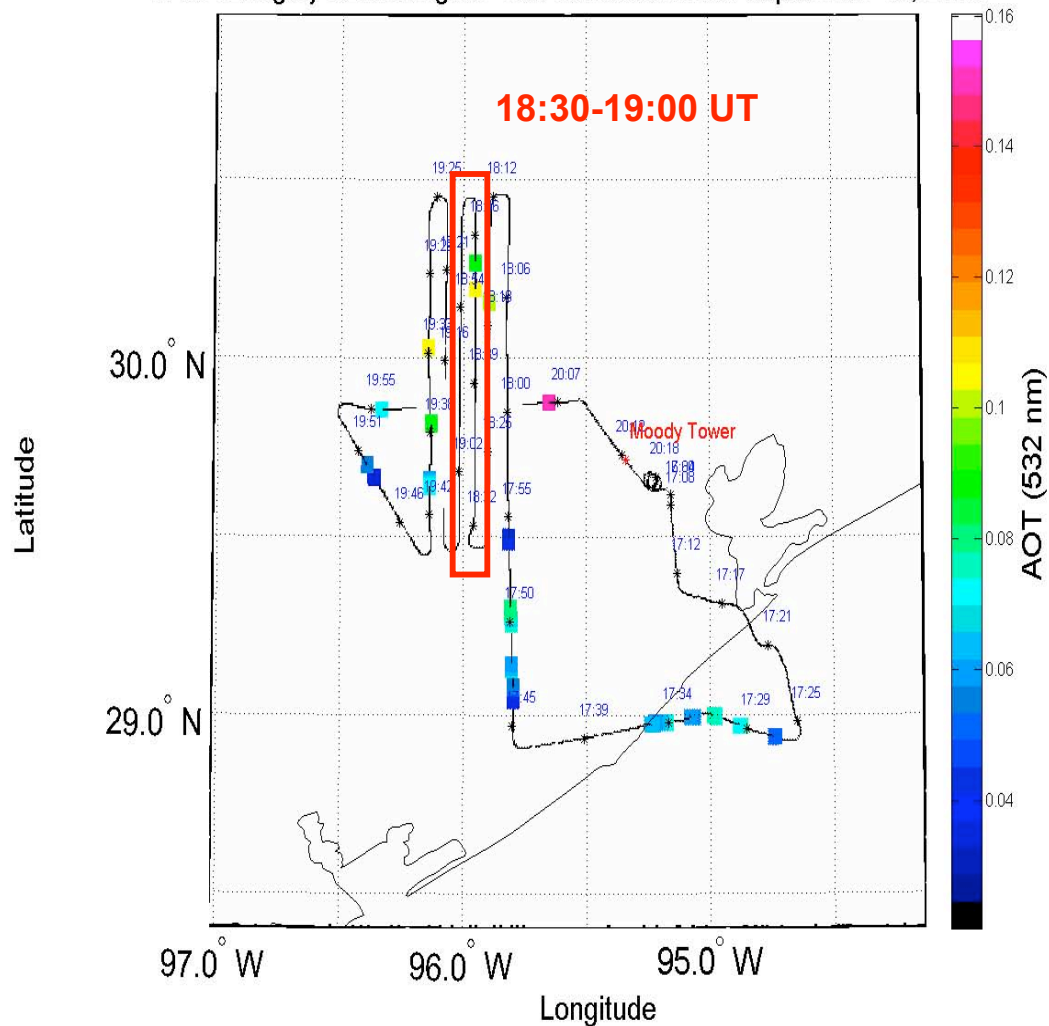
NASA Langley B200 King Air TexAQS/GoMACCS September 15, 2006



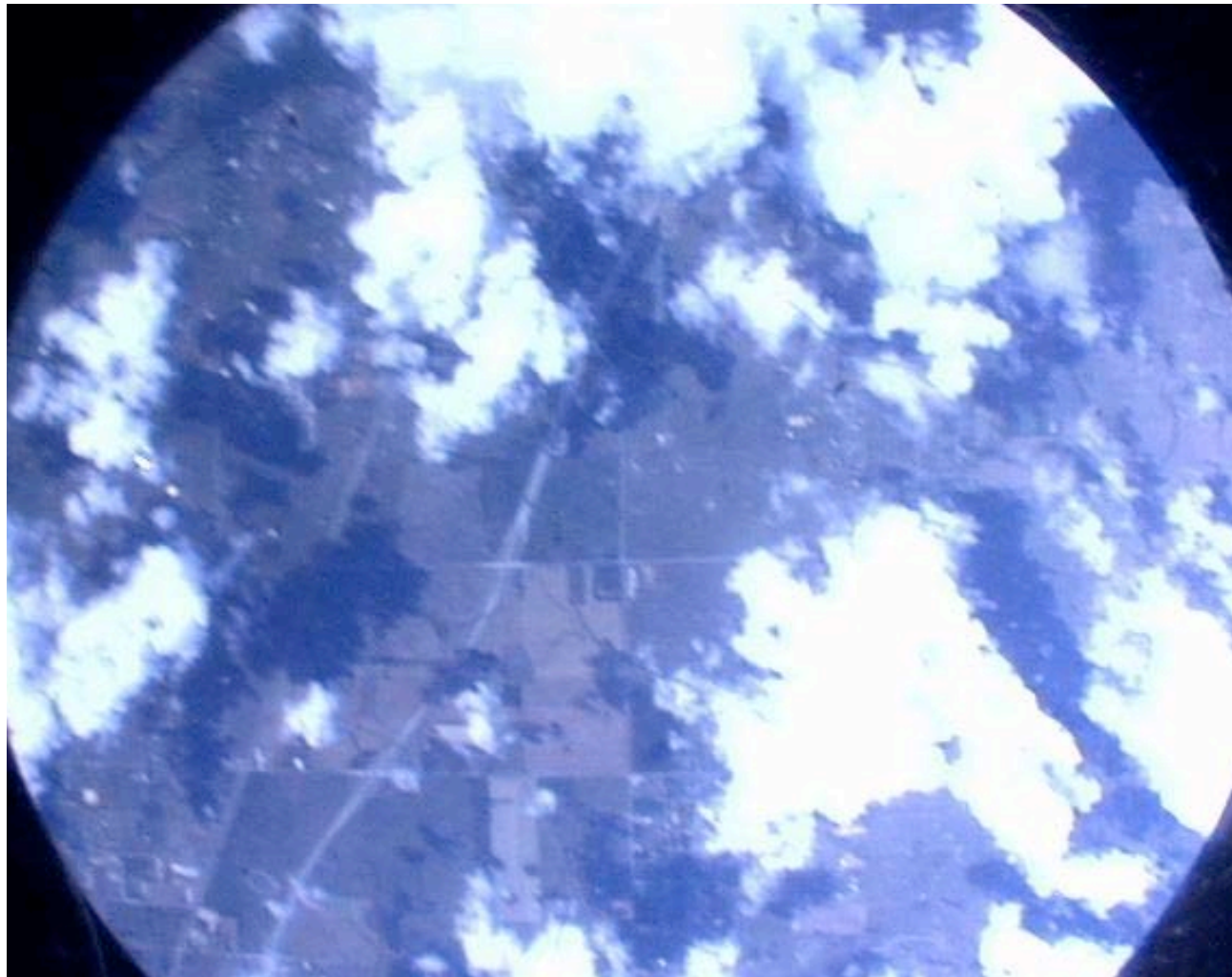
Aerosol between/above broken Cu: Precursor to CHAPS campaign



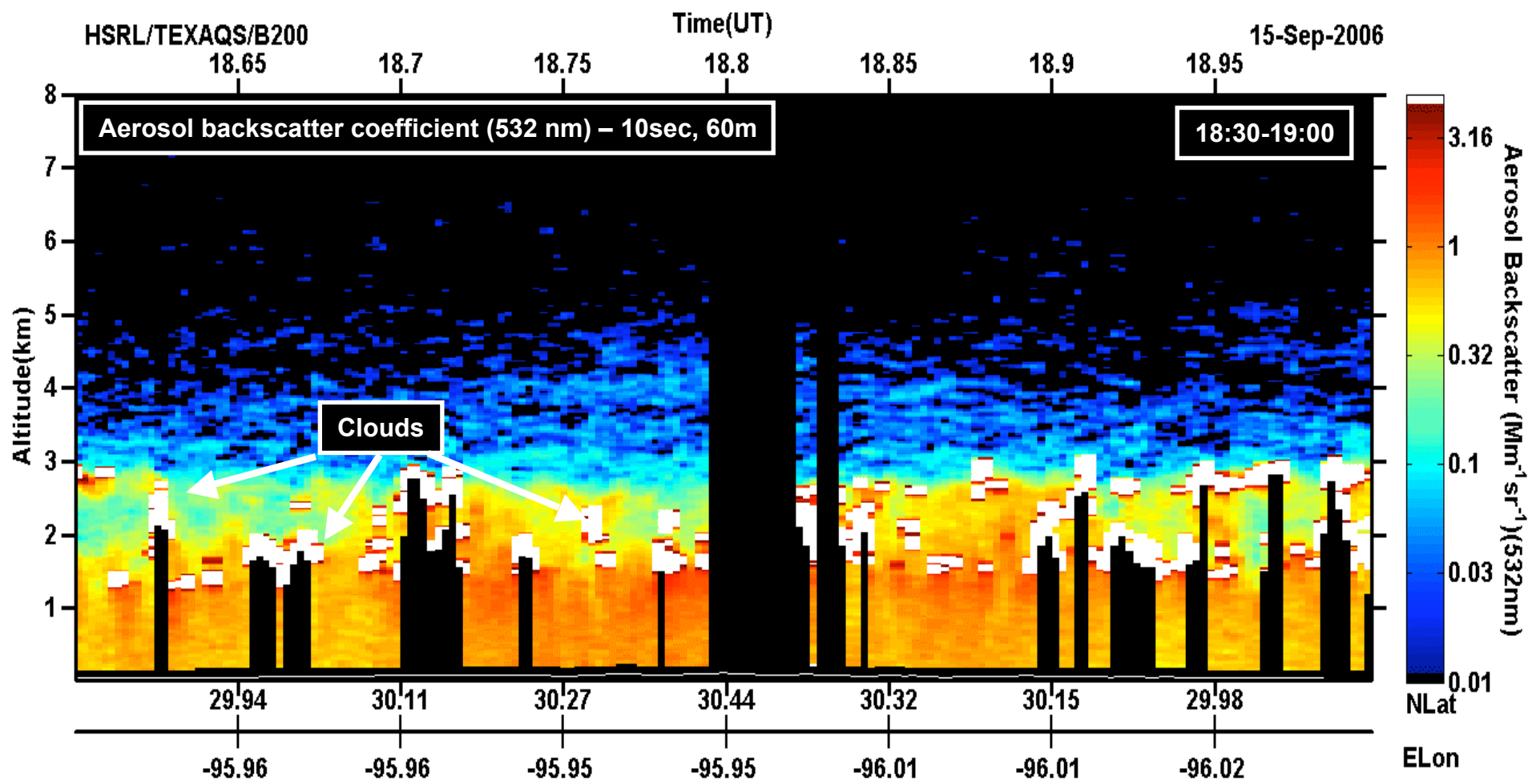
NASA Langley B200 King Air TexAQS/GoMACCS September 15, 2006



Onboard Digital Camera



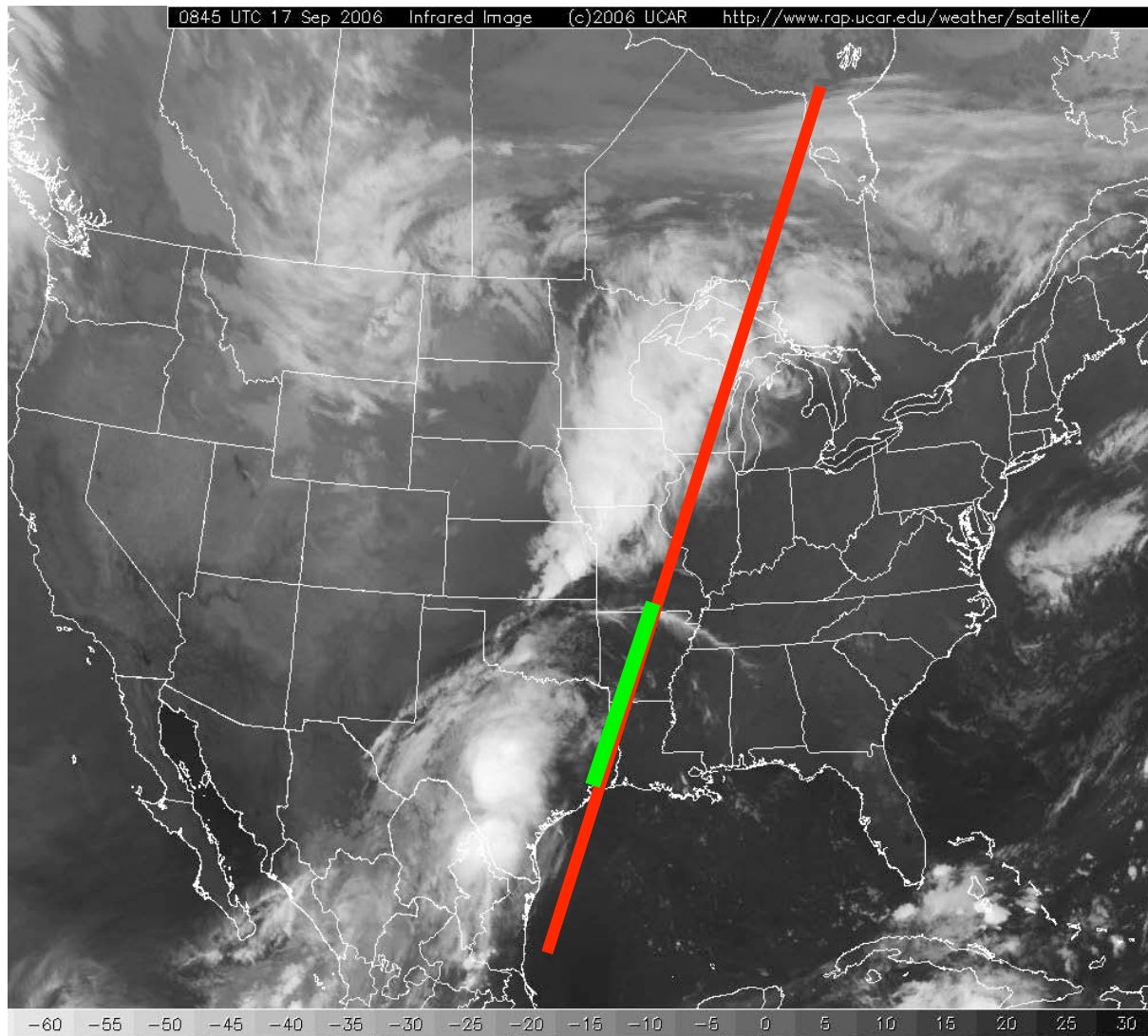
Aerosol Backscatter between/above broken Cu: Precursor to CHAPS campaign



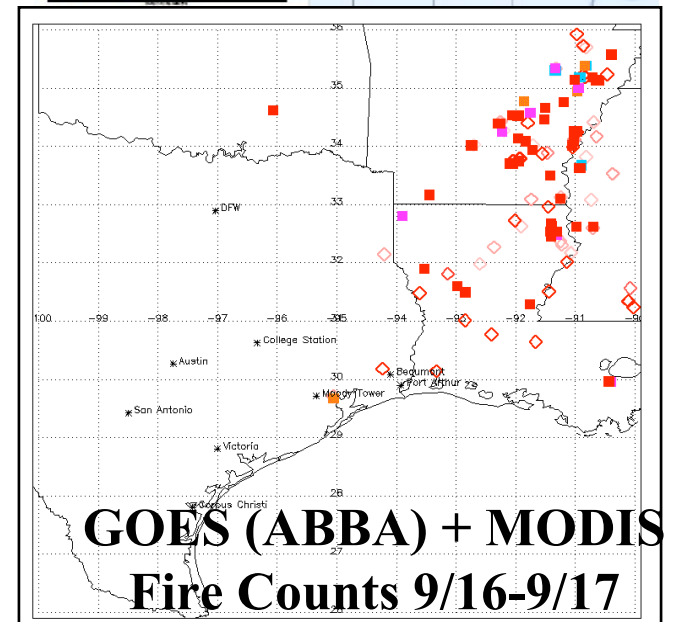
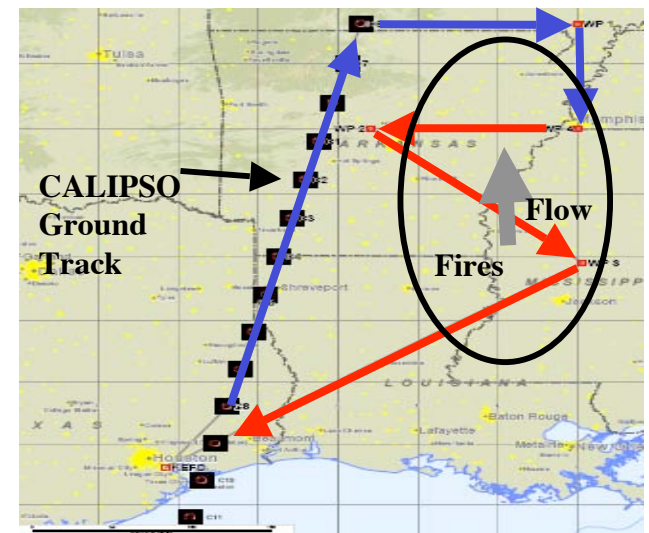
Characterizing Aerosol Distribution & Type: Satellite Validation & Model Verification



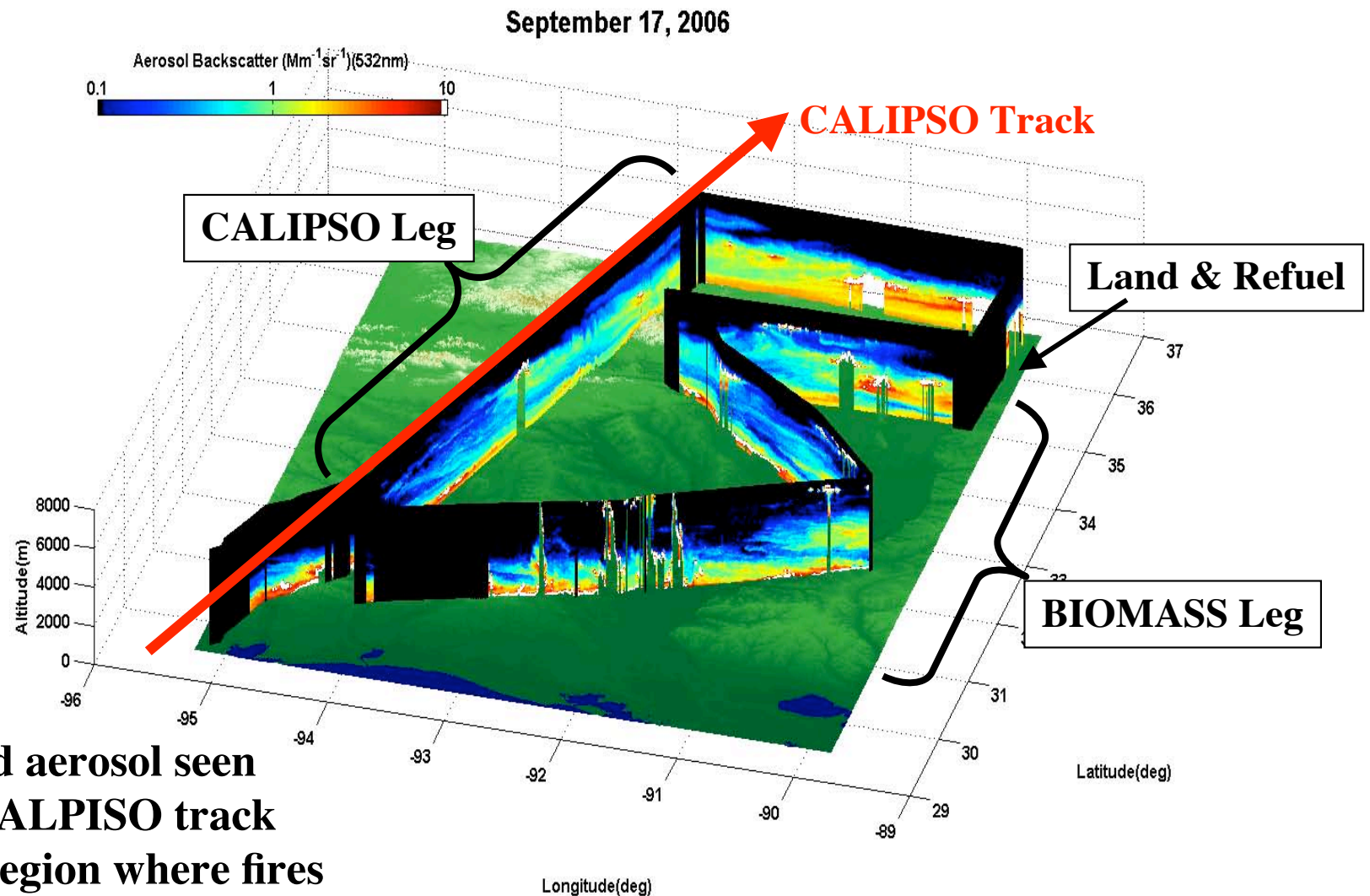
- CALIPSO validation under-flight
- Raster pattern to sample smoke from fires



NASA King Air Flight Plan



Characterizing Aerosol Distribution & Type: Satellite Validation & Model Verification



**Elevated aerosol seen
along CALPISO track
and in region where fires
have been detected.**

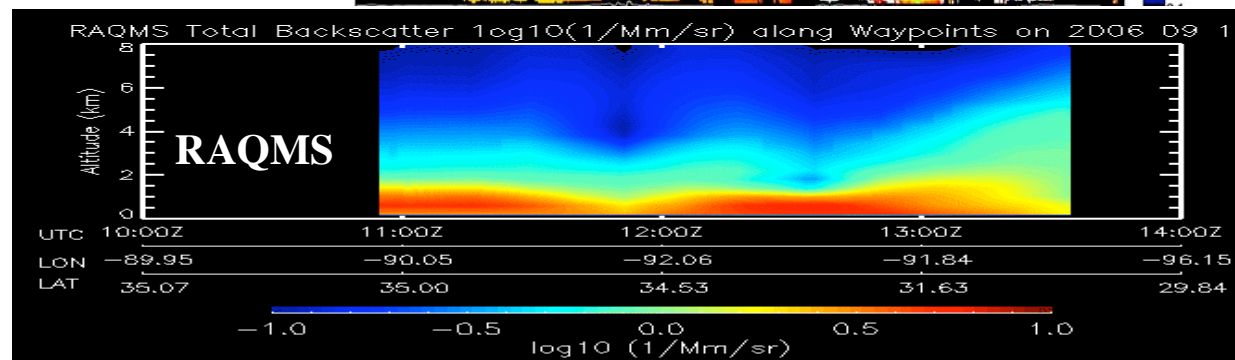
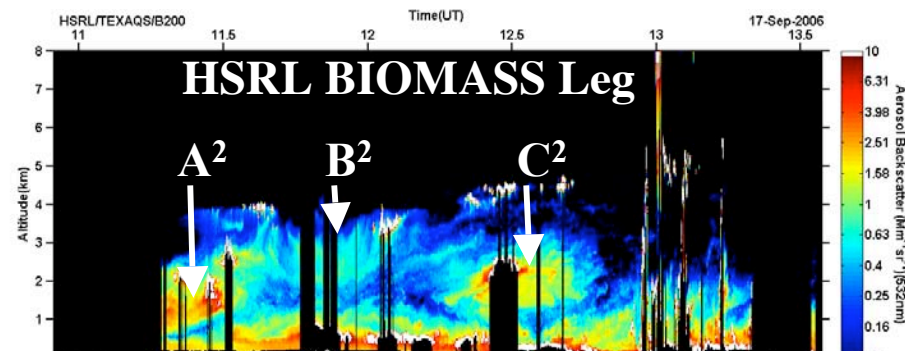
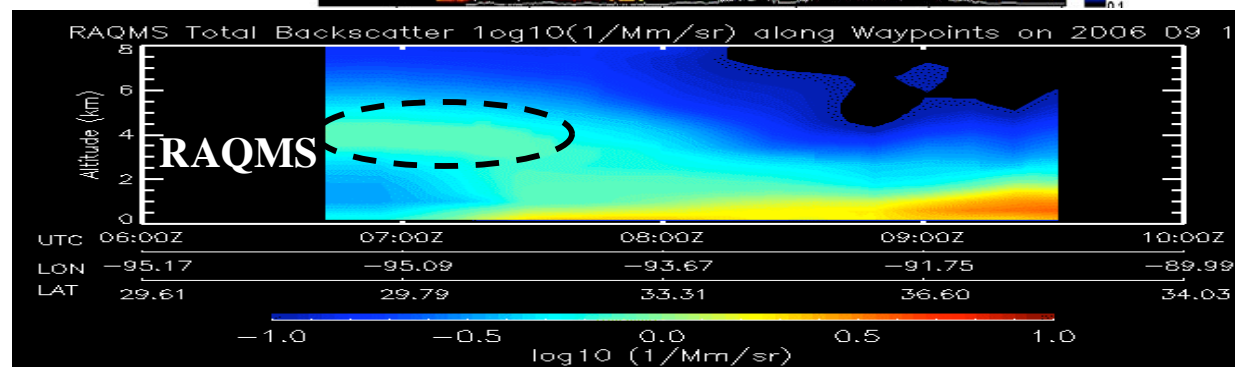
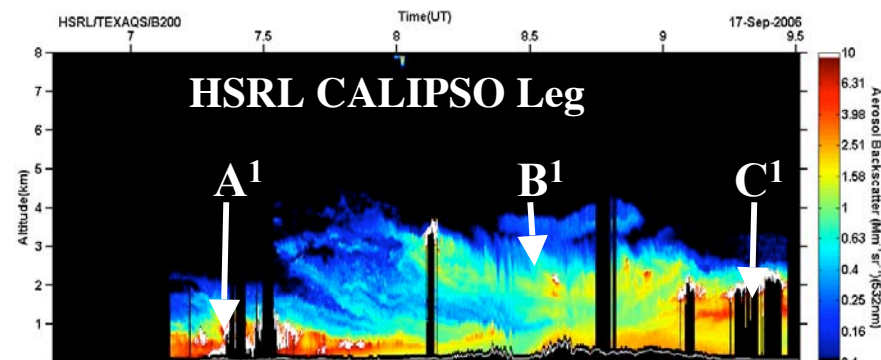
HSRL Model

Verification: aerosol backscatter distribution

RAQMS_{regional} (80km)

RAQMS provides a good prediction of the magnitude of BL aerosol backscatter, but:

- 1) misses elevated aerosol suspected of being smoke (B¹, C¹, A², B², C²) and BL enhancement near Houston (A¹)
- 2) predicts elevated aerosol layer at beginning of CALIPSO underflight that is not observed (dash)



Much to Do

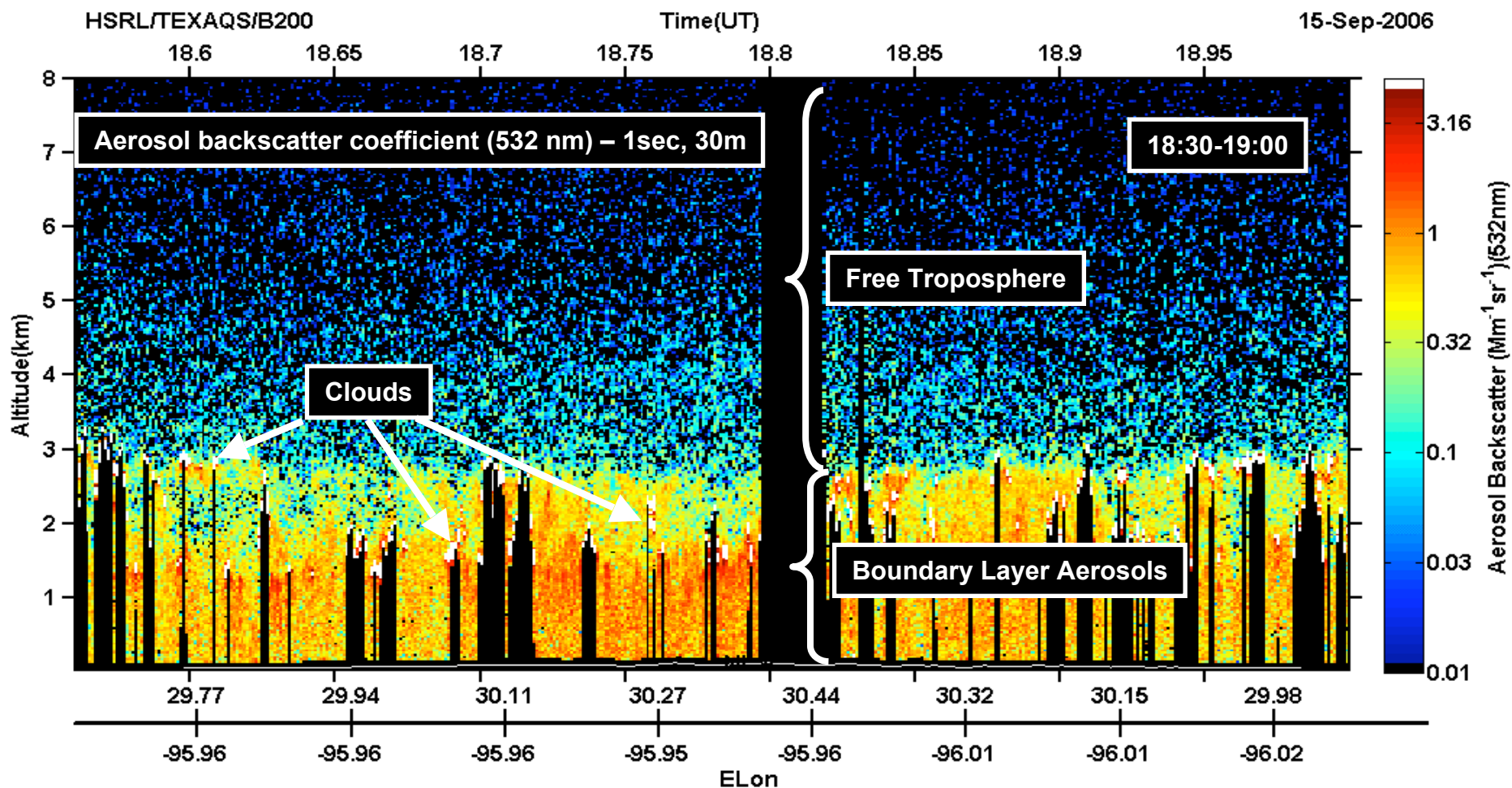


- Extensive set of interesting observations with varying types and loading - have only begun to scratch the surface.
- Lidar data images are on the NOAA TexAQS/GoMACCS site (open access)
 - <http://esrl.noaa.gov/csd/2006/HSRL/>
- Welcome science collaborations and data intercomparisons

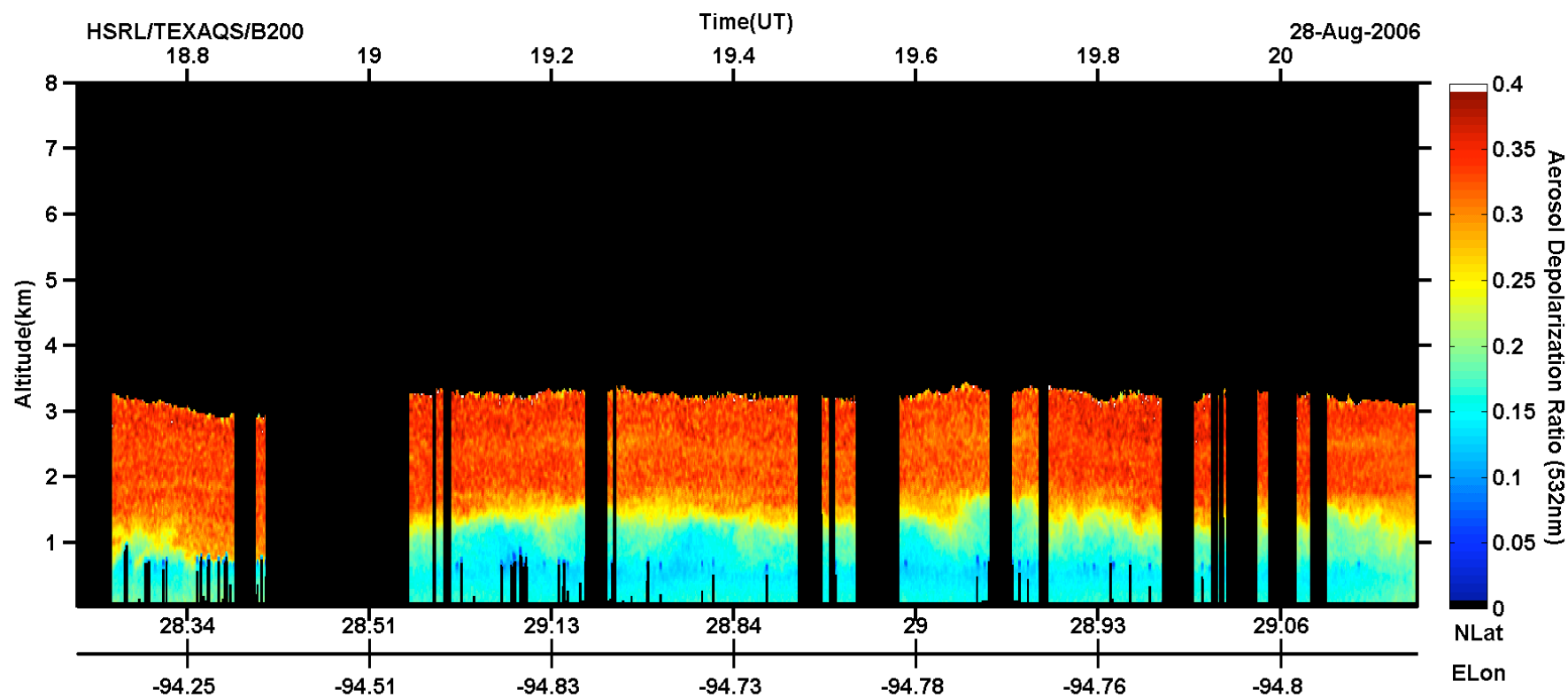


- Backup Slides

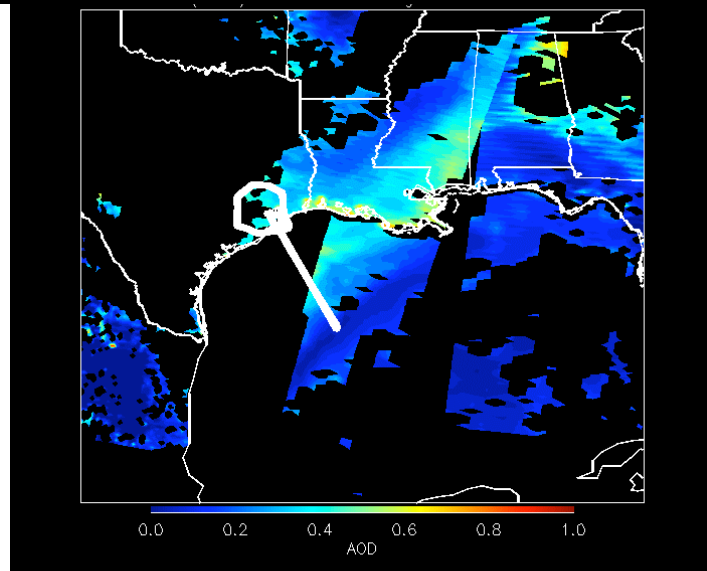
Aerosol Backscatter between/above broken Cu: Precursor to CHAPS campaign



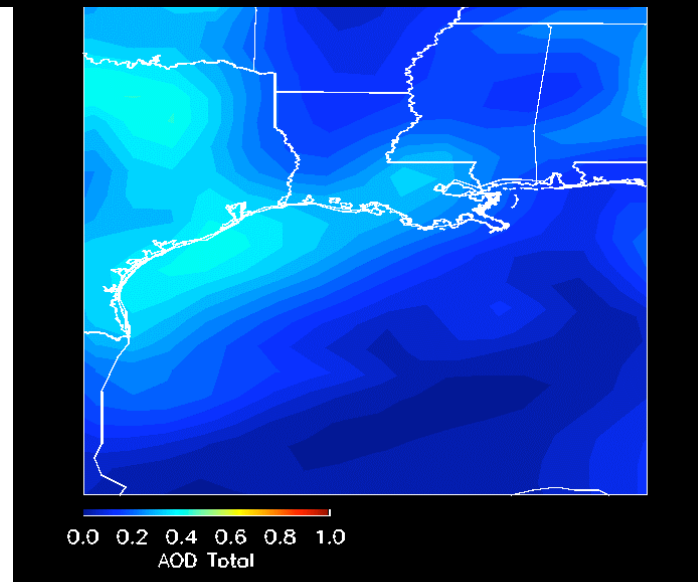
28 August: Saharan Dust Layer Apparent in Aerosol Depolarization Signature



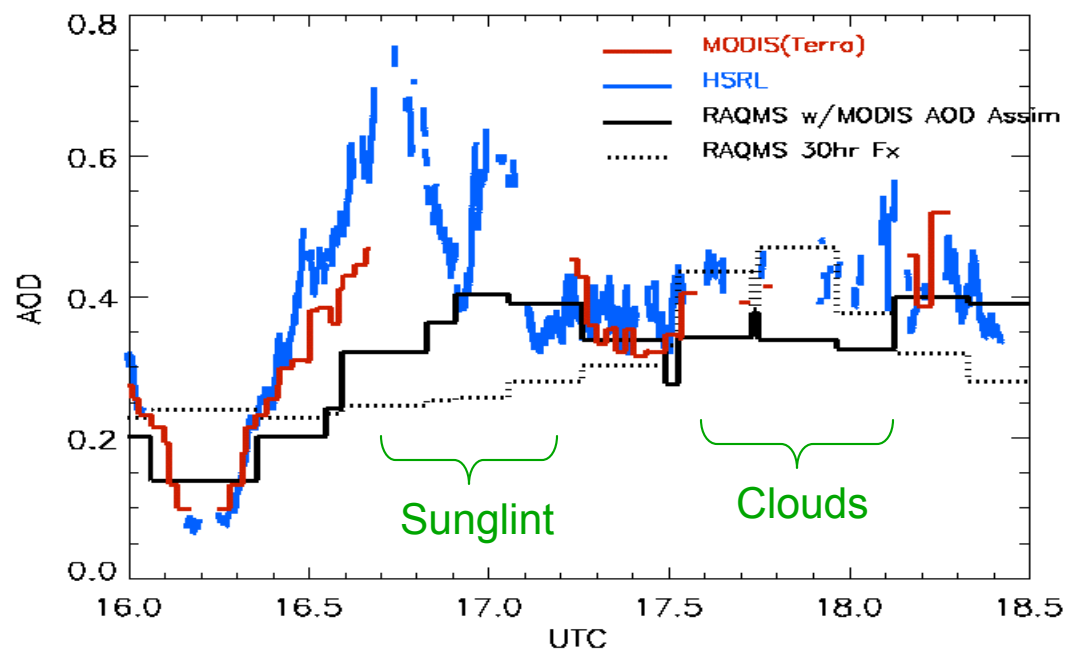
MODIS AOD and HSRL Flight Track 2006 09 03



RAQMS AOD (2006 09 03 18Z) with MODIS AOD Assimilation



HSRL, MODIS and RAQMS AOD Comparisons 2006 09 03



- Opportunity to compare measurements along strong gradients of aerosol loading
- Very good agreement between MODIS AOD and HSRL AOD
- MODIS AOD Assimilation improved RAQMS AOD